North Korea's Missile Program and Supply-Side Controls: lessons for countering illicit procurement

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Abstract: Despite one of the most extensive sanctions regimes in history, including an embargo on missile technologies, North Korea has taken huge steps forward in its ballistic missile program. This article provides insights into the limitations of, and challenges in implementing, supply-side approaches to missile nonproliferation. Considering North Korea's recent progress and efforts to evade sanctions, the article highlights the continuing need to strengthen efforts to counter illicit trade in missile-related technologies. The article makes recommendations in three areas in which missile nonproliferation efforts could be strengthened: cooperatively through furthering the UNSCR 1540 agenda, "bottom-up" by engaging the private sector, and more unilaterally through developing a greater understanding of proliferation networks and working to enhance the toolset available to counter them. While derived from the in-depth missile case study presented, these recommendations have value more broadly in countering the illicit trade in WMD-related technologies.

North Korea took huge steps forward in its ballistic missile program in 2017, conducting successful tests of two Intercontinental Ballistic Missile (ICBM) designs seemingly capable of striking the Continental US, alongside a handful of other successful firsts. Considering this progress, this article provides insights into the limitations of, and challenges in implementing, supply-side approaches to missile nonproliferation. While the DPRK may have already overcome this range of supply-side controls put in place by the international community, the North Korean case provides some insights to strengthen future efforts to counter the illicit trade in missile-related technologies.

The article begins by summarizing recent discussions regarding North Korea's technical successes, before considering the North Korean networks that have sourced missile-related technologies, advanced manufacturing capabilities, and know-how and intangibles in the face of "insufficient and highly inconsistent" sanctions implementation around the world.[1] Building on

[1] "Insufficient and highly inconsistent" used by the UN Panel: UN Security Council, 'Report of the Panel of Experts Established Pursuant to Resolution 1874 (2009)', S/2017/150, 27 February 2017, p.4.

this analysis of the failure of supply-side controls, the article considers three areas in which missile nonproliferation efforts could be strengthened: cooperatively through furthering the UNSCR 1540 agenda, "bottom-up" by engaging the private sector, and more unilaterally through developing a greater understanding of proliferation networks and working to enhance the unilateral toolset available to counter them. While derived from the in-depth missile case study presented, these recommendations have value more broadly in countering illicit trade in other WMD-related technologies.

Missile Milestones under Kim Jong-un

The North Korean missile program has accelerated since Kim Jong-un assumed power following his father's death in December 2011. Almost three-quarters of the missile flight tests undertaken in North Korea have taken place under Kim Jong-un's leadership.[2] 2017 was a year of firsts, notably including three successful ICBM tests in the latter half of the year, with both the Hwasong-14, and the more capable Hwasong-15 demonstrating the capability to strike the Continental US.[3] With the successful Hwasong-15 test, Kim Jong Un alleged that "the historic cause of completing the state nuclear force… was realized".[4] These ICBM successes came against a background of testing of various other new missile systems in 2016 and 2017: a Submarine Launched Ballistic Missile (SLBM) and its land-based variant, a new Intermediate Range Ballistic Missile (IRBM), and a new variant of the Scud system.

On the road towards these milestones, North Korea initially moved from reproducing Soviet-designed systems to producing its own similar or scaled-up variants.[5] Other longer-range systems –mostly presented as space launch vehicles– have seemingly drawn together constituent parts of missiles to produce novel designs.[6] Many commentators have also noticed possible Russian design heritage reflected in the *Musudan* missile, noting similarities with the SS-N-6 SLBM, and that engineers from the relevant Russian design bureau may have travelled to North Korea in the

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[2] 31 tests took place before the death of Kim Jong-il in December 2011; 117 tests took place in total (as of July 2018). Missile test data from Center for Nonproliferation Studies, "North Korea Missile Test Database", <http://www.nti.org/analysis/articles/cns-north-korea-missile-test-database/>, accessed 10 July 2018.
[3] See for example – David Wright, "North Korea's London Missile Test Yet", All Things Nuclear, 28 November 2017, <https://allthingsnuclear.org/dwright/nk-longest-missile-test-yet>, accessed 10 July 2018.
[4] "Kim Jong Un Guides Test fire of ICBM Hwasong-15", KCNA, 29 November 2017, available from KCNAwatch.co, <https://kcnawatch.co/newstream/1511960471-567278968/kim-jong-un-guides-test-fire-of-icbm-hwasong-15/>, accessed 10 July 2018.
[5] See for example how North Korea replicated and scaled up the Scud to create the Nodong: Joseph S. Bermudez Jr., "A History of Ballistic Missile Development in the DPRK", CNS Occasional Paper No.2, 1999, p.20.
[6] See 'Missile Technology Control Regime (MTCR): North Korea's Missile Program', cable from the Secretary of State to the US Embassy in Paris, France, 09STATE103755_a, 6 October 2009, document obtained by Wikileaks, <https://search.wikileaks.org/plusd/cables/09STATE103755_a.html>, accessed 24 December 2017.

early 1990s.[7] However, some of the newer missiles unveiled –including the ICBMs– have an unclear design heritage and could well be indigenous North Korean designs. Debate is still ongoing regarding North Korea's manufacturing capability, and the genesis of recent successes.

For example, some analysts and reporters have claimed that the program has benefitted from significant external sources of technology. A heated debate occurred between analysts in summer 2017 regarding the origins of liquid-fueled engines used in the Hwasong-12 IRBM and Hwasong-14 ICBM. Michael Elleman suggested that these missiles utilized a modified RD-250 engine, noting that "an unknown number of these engines" –likely a "few dozen"– were "probably acquired though illicit channels operating in Russia and/or Ukraine".[8] Reports in September 2017 suggested that North Korea was reliant on imports of advanced missile fuels.[9] Most recently, March 2018 analysis in *Jane's Intelligence Review* suggested that the Hwasong-15 likely benefitted from external "knowledge, technology or hardware", and speculated over connections between the missile and a Soviet design from the 1960s.[10] Most of the claims of North Korean technological dependence have been based on limited or questionable evidence, or heavily disputed by other missile experts.[11] Analysts disputing claims of significant and clandestine external support have tended to argue that North Korea has managed to successfully indigenously produce these, and other requisite missile technologies, after decades of effort.[12]

Indeed, evidence of significant –and possibly state-sanctioned– transfers of goods, materials or technical support is currently lacking. However, there is clear evidence that North Korea has benefitted from dual-use technologies procured from the international market to advance its program. Despite the secrecy surrounding procurement networks, there is still sufficient evidence in the public domain to draw lessons for future missile nonproliferation efforts.

Procurement from the International Marketplace

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[7] For example, see: Jeffrey Lewis, "Origins of the Musudan IRBM", *Armscontrolwonk blog*, 11 June 2012, <https://www.armscontrolwonk.com/archive/205337/origins-of-the-musudan-irbm/>, accessed 10 July 2018.
[8] Michael Elleman, 'The secret to North Korea's ICBM success', *IISS Voices*, 14 August 2017, <https://www.iiss.org/en/iiss%20voices/blogsections/iiss-voices-2017-adeb/august-2b48/north-korea-icbm-success-3abb>, accessed 10 July 2018.
[9] William J. Broad and David Sanger, "The Rare, Potent Fuel Powering North Korea's Weapons", *New York Times*, 17 September 2017.
[10] Markus Schiller and Nick Hansen, "Retro Rocket", *Jane's Intelligence Review*, March 2018, pp.8-15.
[11] On the Ukraine connection see for example, Mariana Budjeryn and Andre Zhalko-Tytarenko, "Missile Engines: Not From Ukraine", Atlantic Council, 12 September 2017, <http://www.atlanticcouncil.org/blogs/ukrainealert/north-korean-missile-engines-not-from-ukraine>, accessed 10 July 2018; on fuel production see Jeffrey Lewis et. al., 'DPRK Domestic Production of UDMH', *Armscontrolwonk blog*, 27 September 2017, <https://www.armscontrolwonk.com/archive/1204170/domestic-udmh-production-in-the-dprk/>, accessed 10 July 2018.
[12] See for example Joshua H. Pollack, 'How North Korea makes its missiles', *NK News.org*, 18 August 2017.

From the early days of the missile program –and continuing after UN sanctions were put in place in 2006– the DPRK has sourced a wide variety of "dual-use" technologies from the international marketplace. Dual-use goods can have utility in WMD and military programs, or civilian applications. Rather than full missile systems or parts, they include many of the requisite technologies for manufacture –for example, materials, electronic components, chemicals for propellants, computers and testing equipment.[13] Since UN sanctions banned North Korea's import of these technologies in 2006, several examples (likely the "tip of the iceberg") of attempts to illicitly procure these types of goods have been uncovered by governments and the UN sanctions Panel of Experts.

Two launches of the Unha-3, purportedly a space launch vehicle, in 2012 and 2016 provide some insights into North Korea's use of foreign-sourced components. Following the tests, the South Korean military fished some of the wreckage out of the sea. The 2012 launch included 14 different foreign-origin items including vintage Soviet and cannibalized Scud parts, and electronic components from China, South Korea, Switzerland, and the UK and US.[14] The debris from the 2016 launch also included similar foreign-sourced electronics.[15]

By contacting the manufacturers with component serial numbers, the UN Panel of Experts attempted to gain insights into the DPRK's illicit supply chains. Similar UK-origin pressure transducers were found in both rockets – those from the 2012 debris were procured through a Taiwanese entity, while those in the 2016 debris appear to have been procured through Chinese intermediaries.[16] The UN Panel of Experts noted of the 2016 launch that almost all the foreign components recovered were "off-the-shelf items that do not meet any of the specifications in the lists of prohibited items".[17] Using foreign-sourced components does not necessarily reflect North Korean dependency or inability to produce them– it may be more economically viable and fairly easy to import them, and the goods themselves are likely of a higher quality.

A second example –this time at the larger and more finished end of the spectrum– relates to the truck chassis used in the Transport Erector Launchers (TELs). In 2012, six large eight-axle TELs were exhibited during a parade in Pyongyang carrying an early ICBM design.[18] The chassis of these vehicles had been exported to the DPRK from China in 2011, with the stated end-use of

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[13] See for example the technologies listed in Category II of the "MTCR Equipment, Software and Technology Annex" available from <http://mtcr.info/wordpress/wp-content/uploads/2017/10/MTCR-TEM-Technical_Annex_2017-10-19-corr.pdf>, accessed 10 July 2018.
[14] UN Security Council, 'Report of the Panel of Experts Established Pursuant to Resolution 1874 (2009)', S/2014/147, 6 March 2014, p.22-23.
[15] UN Security Council, 'Report of the Panel of Experts Established Pursuant to Resolution 1874 (2009)', S/2017/150, 27 February 2017, p.27-28.
[16] *Ibid*, p.27.
[17] UN Security Council, 'Report of the Panel of Experts Established Pursuant to Resolution 1874 (2009)', S/2014/147, 6 March 2014, p.23.
[18] Larry Shaughnessy, 'Truck raises questions about China's role in North Korea's missile program', *CNN Online*, 20 April 2012.

transporting timber.[19] The UN Panel of Experts noted that the DPRK "deliberately breached the end user guarantee" in turning the trucks into TELs.[20] However, given the Chinese company's role in supplying the Chinese missile program, it is unlikely they were completely oblivious to potential missile-related end uses in North Korea.

A Focus on Indigenization?

Arguably the most important technologies that North Korea has shown a significant interest in procuring are manufacturing capabilities –for example, advanced Computer Numerically Controlled (CNC) machine tools. These tools can be used to accurately machine parts for a wide variety of applications, including for use in ballistic missiles. Whether this interest –as shown through the state media– has translated into actual advances in missile technology or is merely propaganda remains to be established.[21] North Korea likely started to reverse-engineer machine tools procured from the Soviet Union in the 1990s. However, the country has continually sought CNC tools and constituent technologies from the international market place.

Members of the Tsai family have allegedly been involved in supplying machine tools to North Korea since the late 1990s.[22] In 2008, Taiwan-based Alex Tsai was indicted by a Taiwanese court for the re-export of three types of US-origin machine tools to North Korea. In 2013, Alex and his son Gary were arrested by the US authorities, Gary having established a US-based company to facilitate exports of "hundreds of thousands of dollars" of machine tools to his father for re-export to North Korea.[23]

Other cases have seen Chinese manufactured machine tools, some incorporating European-origin technology, being exported to North Korea.[24] Images from a 2016 factory visit by Kim Jong-un showed a robotic arm attached to a CNC with a Swiss company logo visible.[25] North Korea's Ryonha Machinery Corporation, a UN designated machine tool manufacturer, can likely produce

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[19] UN Security Council, 'Report of the Panel of Experts Established Pursuant to Resolution 1874 (2009)', S/2013/337, 11 June 2013, p.27.
[20] *Ibid*, p.27.
[21] For background on North Korea's interest in CNC technology, see: James Pearson and Hyonhee Shin, "How a homemade tool helped North Korea's missile program", *Reuters*, 12 October 2017.
[22] US Department of the Treasury, 'Treasury Targets Taiwanese Proliferators', press release, 16 January 2009, <https://www.treasury.gov/press-center/press-releases/Pages/hp1359.aspx>, accessed 10 July 2018.
[23] United States of America v. Hsien Tai Tsai, 'Criminal Complaint', United States District Court, Northern District of Illinois, Eastern Division, 23 October 2012; UN Security Council, 'Report of the Panel of Experts Established Pursuant to Resolution 1874 (2009)', S/2014/147, 6 March 2014, p.24.
[24] See for example the case listed in UN Security Council, 'Report of the Panel of Experts Established Pursuant to Resolution 1874 (2009)', S/2017/150, 27 February 2017, p.65; Joby Warrick, 'Kim Jong Un's rockets are getting an important boost —from China', *Washington Post*, 13 April 2017.
[25] Alastair Gale & Jonathan Cheng, "Inside North Korea's Accelerated Plan to Build a Viable Missile", *Wall Street Journal*, 15 May 2017.

indigenous copies of machine tools and seemingly attempted to export these through Chinese and Russian front companies in 2014 after its designation.[26] However, North Korea is still likely reliant on certain foreign components and parts for more advanced machines.[27]

The Modus Operandi of North Korea's Procurement Networks

North Korea's WMD-related illicit procurement networks generally involve middlemen targeting suppliers and distributors using well understood deceptive means to hide the ultimate end use of the goods. The techniques used by these illicit procurement networks have been frequently used by those pursuing technologies for outlawed or clandestine WMD programs. For example, North Korean procurement agents have set up and utilized front companies and multiple aliases, provided false end-user details, falsified paperwork, co-opted unscrupulous or indifferent suppliers, and exploited naïve or nonchalant distributors.

These efforts have frequently made use of existing business networks and diaspora populations, as well as North Korean diplomats and intelligence operatives based overseas. For example, this year German intelligence officials have stated that the North Korean embassy in Berlin had been used to procure unspecified dual-use missile and nuclear related goods.[28] Elements of North Korean intelligence are heavily involved in overseas sales of arms, including military goods manufactured using foreign components, and their involvement in illicit WMD-related procurement is also likely.[29]

One factor which has significantly shaped North Korean procurement networks is the country's shared land border with China, its most significant trading partner, accounting for around 90% of North Korea's international trade. China also plays host to a growing number of small private sector companies producing dual-use and missile-related technologies. These sensitive products were previously the preserve of China's large state-owned arms and strategic enterprises.[30] The proximity of such a growing and laxly regulated market for, and producer of, dual use goods – and also a notable transshipment point for WMD programs– on North Korea's border presents an unprecedented challenge for supply-side controls.

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[26] Jeffrey Lewis and Catherine Dill, 'Smoke and Mirrors: DPRK Front Companies in China and Russia', 38North, 18 November 2014, <https://www.38north.org/2014/11/jlewis111814/>, accessed 10 July 2018.
[27] In 2013, the UN Panel of Experts suspected the quality of Ryonha's machines was "low". UN Security Council, 'Report of the Panel of Experts Established Pursuant to Resolution 1874 (2009)', S/2013/337, 11 June 2013, p.30.
[28] "German spy chief alleges North Korea uses Berlin embassy for procurement", *Reuters*, 3 February 2018; Germany-based diplomats had previously sought to acquire machine tools - See UN Security Council, 'Report of the Panel of Experts Established Pursuant to Resolution 1874 (2009)', S/2013/337, 11 June 2013, p.29.
[29] James Pearson and Rosana Latiff, "North Korea spy agency runs arms operation out of Malaysia, U.N. says", *Reuters*, 26 February 2017.
[30] Daniel Salisbury and Lucy Jones, 'Exploring the changing role of Chinese entities in WMD Proliferation', *China Quarterly* (Vol.225, March 2016), pp.50-72.

China is not the only country which has played the role of supplier or transshipment point, with many countries featuring in the DPRK's networks. A 2018 study by the Institute for Science and International Security (ISIS) noted 52 countries had seen UN sanctions violations during 2017.[31] A separate study at King's College London in 2016 noted over 60 countries had been used by the DPRK in its WMD and military procurement activities.[32] North Korea has made especial use of its backyard in East Asia. These countries represent places where the DPRK has pre-existing business networks, and host economies sufficiently advanced to be seeking high-tech dual-use goods without raising alarm. This is seen through use of Taiwanese intermediaries, discussed above, and the expansion of North Korean procurement activities in Hong Kong and other South East Asian hubs since the late 2000s.[33]

In transporting goods to and from North Korea, larger and more specialized shipments –for example complete missile or bulky weapons systems– have tended to be shipped on state-owned vessels, and hidden under bulk cargos. More recently, increased scrutiny on North Korean state-owned carriers, and procurement largely of smaller dual-use items rather than larger full systems, has led to increased use of commercial containerized shipping, transshipment through Chinese ports, and transfer over the Chinese land border.[34]

North Korea's networks have found ways to avoid using the regulated aspects of the international financial system in making payments for goods. This has included exchange of bulk cash for missile-related goods –see for example the $850,000 cash payment Alex Tsai allegedly received from North Korean agents for a machine tool at Singapore airport in 2009.[35] Otherwise, long and complex payment schemes are used, particularly avoiding foreign transactions and involvement of entities obviously linked to North Korea.[36]

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[31] This included violations of the technology embargoes, as well as other sanctions violations listed in the UN Panel reports. David Albright et al. "52 Countries Involved in Violating UNSC Resolutions on North Korea throughout most of 2017", ISIS Report, 9 March 2018, <http://isis-online.org/uploads/isis-reports/documents/52_Countries_Involved_in_Violating_NK_UNSC_Resolutions_in_2017_9Mar2018_Final_%281%29.pdf>, accessed 10 July 2018.

[32] "North Korea's Proliferation & Illicit Procurement Apparatus", *Project Alpha Report*, King's College London, May 2016, p.13.

[33] John Park and Jim Walsh, 'Stopping North Korea, Inc.: Sanctions Effectiveness and Unintended Consequences', *MIT Security Studies Program Report*, August 2016, p.2.

[34] UN Security Council, 'Report of the Panel of Experts Established Pursuant to Resolution 1874 (2009)', S/2012/422, 14 June 2012, p.36.

[35] '(S) DPRK Proliferation-related Transaction in Singapore', cable from the Secretary of State to the US Embassy in Singapore, 09STATE36855_a, 14 April 2009, document obtained by Wikileaks, <https://wikileaks.org/plusd/cables/09STATE36855_a.html>, accessed 24 December 2017.

[36] See for example the Royal Team Corporation example in supplying foreign components for the Unha-3. UN Security Council, 'Report of the Panel of Experts Established Pursuant to Resolution 1874 (2009)', S/2017/150, 27 February 2017, p.62.

Enforcement actions undertaken by the US against large Chinese networks in 2016 and 2017 have shown how Chinese middlemen and women have used private ledger systems, importing and selling North Korean coal in China, and using proceeds to fund exports of everything from sugar, to fertilizer, luxury goods and missile-related dual-use items to North Korea.[37] These schemes have allowed designated North Korean entities to access the US financial system through Chinese intermediaries and shell companies registered in financial havens.

Intangibles, Expertise and Espionage

North Korea has long sought expertise and know-how for its missile program –what are often described as "intangibles". Over the years, the DPRK's program has benefitted from different sources –from very early collaboration with Soviet and Chinese scientists in the 1960s and 1970s, to the efforts to attract scientists to move to the country from the Former Soviet Union in the 1990s.

Attempts to insulate North Korea's program from international expertise and collaboration have had limited success. The travel bans on designated individuals and those associated with various entities are known to have been breached repeatedly, with most cases reported publically relating to missile and arms exports rather than acquisition of technology and know-how.[38] However, a case in 2017 did see Thailand implement sanctions by rejecting four visa applications by North Korean nationals to attend a course on satellite technology.[39]

North Korea's missile-related collaboration with Iran is well known, with extensive exports of missiles to the country during the Iran-Iraq war, and through continued exchange of missile technology into the 2000s. More recent US intelligence assessments suggest that Iran-North Korean exchanges of technology have slowed, although current exchanges of expertise are unclear.[40] However, in 2016 the US Treasury sanctioned Iranian missile-related entities, noting

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[37] See for example the cases of Chi Yupeng – court documents suggest "dual use goods" were transferred. United States of America v. $4,083,935.00 of funds associated with Dandong Chengtai Trading Limited, 'Complaint', United States District Court for the District of Columbia, filed 22 August 2017, p.19, <https://www.justice.gov/usao-dc/press-release/file/992451/download>, accessed 10 July 2018. And DHID – a study by C4ADS provided evidence that the DHID network was supplying dual-use technologies. 'In China's Shadow', C4ADS and the ASAN Institute Report, August 2016, p.34-36.

[38] See for example, UN Security Council, 'Report of the Panel of Experts Established Pursuant to Resolution 1874 (2009)', S/2017/150, 27 February 2017, p.68.

[39] 'Letter dated 7 December 2017 from the Permanent Representative of Thailand to the United Nations addressed to the Chair of the Committee', S/AC.49/2017/140, 12 December 2017 <http://www.un.org/ga/search/view_doc.asp?symbol=S/AC.49/2017/140>, accessed 10 July 2018.

[40] See for example suggestion of Iran's decreasing dependency on DPRK-origin missile parts, and Clapper's remarks on Iran not receiving assistance for its ICBM efforts. Paul K. Kerr, Steven A. Hildreth and Mary Beth D. Nikitin, 'Iran-North Korea-Syria Ballistic Missile and Nuclear Cooperation', CRS Report, R43480, 26 February 2016, p.4.

that in recent years, engineers from Iran's liquid-fueled missile program "traveled to North Korea to work on an 80-ton rocket booster".[41]

The North Korean program has also clearly benefitted from access to foreign academic institutions. A 2017 UN report noted that the main North Korean universities feeding the missile program had "bilateral agreements" with at least four Chinese and two Russian academic institutions.[42] Reporting has also suggested that "hundreds" of North Korean scientists have studied outside the country in recent years, many at Chinese universities, even with Chinese government scholarships, and some on topics relevant to missile technologies.[43] The DPRK has also used foreign universities to access global scholarly research, with North Korean students at one Chinese university downloading 57,000 academic papers on a single day in 2017.[44]

The DPRK has also –with unclear levels of success– sought to employ industrial espionage to access sensitive missile-related information. In 2011 two North Korean diplomats based in Belarus travelled to Ukraine, seeking to gain access to "secret academic theses" from a Ukrainian rocket design bureau.[45] These documents would have provided information on "new forms of technological processes for the design of missile systems, liquid-propellant engines, spacecraft and missile fuel supply systems and associated computer programmes".[46] The two North Korean officials were arrested by the Ukrainian authorities in a dramatic sting operation, the footage of which was released to the media last year.[47] These North Korean agents currently remain in prison in Ukraine.

Lastly, but perhaps most importantly, North Korea has likely benefitted from the availability of technical information in open sources –including online. Many technologies currently of interest to the North Korean missile program were mastered by the US and USSR from the 1950s onwards. Limited efforts by governments to prevent sensitive technical information from making its way online have been easily overwhelmed by the growing scale of this new challenge to export control.

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[41] US Department of the Treasury, 'Treasury Sanctions Those Involved in Ballistic Missile Procurement for Iran', press release, 17 January 2016, <https://www.treasury.gov/press-center/press-releases/Pages/jl0322.aspx>, accessed 10 July 2018.
[42] UN Security Council, 'Report of the Panel of Experts Established Pursuant to Resolution 1874 (2009)', S/2017/150, 27 February 2017, p.49.
[43] Jeremy Page and Alastair Gale, 'Behind North Korea's Nuclear Advance: Scientists Who Bring Technology Home', *Wall Street Journal*, 6 September 2017.
[44] *Ibid.*
[45] UN Security Council, 'Report of the Panel of Experts Established Pursuant to Resolution 1874 (2009)', S/2013/337, 11 June 2013, p.25.
[46] *Ibid.*
[47] Nick Paton Walsh, Victoria Butenko and Barbara Arvanitidis, 'The North Korean spies Ukraine caught stealing missile plans', *CNN Online*, 1 September 2017.

The Sanctions Regime and Missile Nonproliferation Efforts

Much of the public discussion of sanctions on North Korea has related to those seeking to address the "demand-side" – measures which have sought to impose financial and diplomatic pressure, making the pursuit of WMD too costly for the Kim regime. Supply-side measures have been utilized by certain states –notably the US– to prevent North Korea's access to WMD technologies since at least the 1990s. However, the mainstay of these supply-side measures has been sanctions imposed by the UN Security Council since 2006.[48] These place a series of standardized legal requirements on all states to prevent the acquisition of WMD technologies by North Korea. In terms of the missile program, the focal point within these UN supply-side measures is the embargo on missile-related technologies, which was first put in place alongside the embargo on nuclear technologies.

In July 2006, following a series of North Korean missile tests, the Security Council *required* that states should "exercise vigilance and prevent" transfers of "missile and missile-related items, materials, goods and technology" to the DPRK.[49] The resolution also sought to limit North Korea's missile industry from gaining hard currency, noting that states should "exercise vigilance and prevent" missile related exports.[50] A resolution later that year strengthened the language, *deciding* states "shall prevent the direct or indirect supply, sale or transfer" of missile technology to North Korea "through their territories or by their nationals, or using their flag vessels or aircraft, and whether or not originating in their territories".[51]

Several other UN measures have also sought to prevent technical assistance and disrupt the activities of North Korea's program. A 2006 UN resolution *decided* "All Member States shall prevent any transfers to the DPRK by their nationals or from their territories" of missile-related "technical training, advice, services or assistance".[52] In 2016 it was further *decided* that states should prevent their educational institutions from providing "specialized teaching or training" to DPRK nationals in WMD related areas, including "aerospace engineering, aeronautical engineering and related disciplines".[53]

The earlier resolutions also imposed asset freezes and travel bans on certain individuals and entities related to the WMD programs.[54] Entities on the "1718 Sanctions List" include those involved in the missile and space programs, missile-related exports and procurement, and

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[48] It should be noted that other countries – such as the US and Japan – had sanctioned North Korea prior to 2006.
[49] UN Security Council Resolution 1695, 15 July 2006, S/RES/1695.
[50] Ibid.
[51] UN Security Council Resolution 1718, 14 October 2006, S/RES/1718.
[52] Ibid, OP8.c. – this provision also dictated states should prevent the training, advice, services and assistance provided by North Korea in this area.
[53] UN Security Council Resolution 2270, 2 March 2016, S/RES/2270, OP17. This language was strengthened from UN Security Council Resolution 1874, 12 June 2009, S/RES/1874, OP28.
[54] UN Security Council Resolution 1718, 14 October 2006, S/RES/1718, OP8.d, 8.e.

financing of these activities.[55] The UN resolutions also prohibit broader activity-based proliferation financing related to North Korea's WMD efforts, including the missile program.[56]

These measures have been put in place against a background of broader efforts to prevent ballistic missile proliferation. Since 1987, the Missile Technology Control Regime (MTCR) has sought to harmonize missile-related export controls among the main missile technology holding states. The MTCR guidelines steer member states decision-making about transfers of missile related goods. These are implemented through national export control systems which must meet certain standards for membership. The associated MTCR Equipment, Software and Technology Annex –listing controlled missile technologies– is used by MTCR member states, and many other national authorities around the world, in their export control systems. Besides frequently updating the MTCR annexes to reflect technological advances, the regime's members also exchange information on missile proliferation trends, and conduct outreach to non-members on the group's activities, and missile nonproliferation efforts.

Lax Sanctions Implementation and Enforcement

The UN sanctions resolutions are legally binding for all states around the world, and national governments are responsible for their implementation within their jurisdictions. However, as Andrea Berger suggested in a recent RUSI report, not a single element of the UN sanctions regime "enjoys robust international implementation".[57] This includes the prohibition on the transfer of missile-related items.

At the national level, the export of missile related-goods and "intangibles" –alongside nuclear, chemical, biological and military technologies– are regulated through national export control systems. Industry must apply for, and receive, an export license before exporting certain proliferation-sensitive goods. This process allows governments to combine information submitted with the license application with classified intelligence to assess whether planned exports could be diverted for nefarious uses. Lists of technologies –nationally derived, but often based on the MTCR Annex– show which missile-related goods and information are "controlled". A "catch-all" provision often means that non-controlled goods require a license if the exporter knows or suspects that they could end up in a WMD program. Other elements of the UN sanctions also need to be implemented at the national level: for example, border control systems are used to implement the travel ban, and academic vetting schemes allow states to prevent North Korean engineers from taking technical courses at foreign universities.

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[55] See "Sanctions List Materials", <https://www.un.org/sc/suborg/en/sanctions/1718/materials>, accessed 10 July 2018.
[56] See for example, UN Security Council Resolution 1874, 12 June 2009, S/RES/1874, OP18.
[57] Andrea Berger, "House without Foundations", Whitehall Report 3-17, RUSI, June 2017.

In theory, all countries should have a basic capacity to implement these UN missile-related sanctions. Since UNSCR1540 was passed in 2004, following the discovery of the AQ Khan network, it has been obligatory for states to have in place an "appropriate effective" export control system, border controls, and measures to prevent proliferation financing.[58] However, almost fourteen years after the resolution's passage, many states –particularly in the developing world– are still struggling to implement its more than 300 requirements.

Even amongst the states that have acted to put in place new, or strengthen existing, export control systems, there are relatively few which have undertaken enforcement action against proliferators. For example, while China has taken significant steps to strengthen its export control systems, it has undertaken little public enforcement action, despite having frequently been exploited by WMD programs as a source of, and transshipment point for, sensitive technologies.[59] Implementation of other missile-related measures, such as the targeted financial measures and travel bans, has also been patchy.[60]

More broadly, the Trump administration did manage to secure significant international cooperation –particularly from Beijing– on the implementation of economic sanctions as part of its "maximum pressure" campaign in early 2018. However, following inter-Korean talks, and in the run-up to the June 2018 Trump-Kim Summit in Singapore, this pressure lapsed and is unlikely to be revived. Such developments could potentially impact on how governments and industry view and respond to North Korean illicit procurement efforts.

States and non-governmental organizations have undertaken significant outreach efforts under the auspices of UNSCR 1540 and UN country-specific sanctions resolutions to help states better understand and implement their obligations. This outreach should continue: to further develop export control and other national systems, as well as furthering efforts to address related issues such as intangible transfers. However, the scarce resources relative to the scale of the challenge, and many states having competing security priorities, have limited the effectiveness of this outreach. Building capacity in states around the world –particularly beyond the obvious supplier states– will have utility for missile nonproliferation beyond the North Korean case.

The Private Sector's Role

[58] UN Security Council Resolution 1540, 28 April 2004, S/RES/1540.
[59] Wyn Q Bowen, Ian J. Stewart and Daniel Salisbury, 'Engaging China in Proliferation Prevention', *Bulletin of the Atomic Scientists,* October 2013, <https://thebulletin.org/engaging-china-proliferation-prevention>, accessed 10 July 2018.
[60] See for example the recent findings of the UN Panel on these issues: UN Security Council, 'Report of the Panel of Experts Established Pursuant to Resolution 1874 (2009)', S/2017/150, 27 February 2017, pp.68-71.

Sanctions and export controls present a complex landscape for industry to comply with. This poses challenges for small and medium sized dual-use exporters, which unlike large defence and aerospace companies have limited resources to expend on compliance. While facing significant challenges and resource constraints, these companies –legitimate businesses keen to abide with the law– can play an important and proactive role in countering illicit procurement.

A good example is provided by UK exporter Rakon UK, a manufacturer of oscillators that can be used in everything from household electronics to ballistic missile guidance systems. In 2005, elements of the British government approached the company to share intelligence that its goods may have benefitted the Iranian missile program.[61] Sitting down together, the government representative and the company's compliance officer could share different pieces of information, which when put together helped the company to prevent the further unintended diversion of its products.

Companies often receive "request for quote" emails which they do not act on because they deem them suspicious. Because they often delete these emails and do not seek an export license, this information is not usually passed on to the national authority. This untapped information can provide vital intelligence about illicit procurement activities. Companies' technical personnel often have a better understanding of the technical specification and capabilities of their products: for example, which models and specifications could be used in missile applications (this does not *always* directly overlap with those listed on control lists). On the other side, governments have access to classified intelligence regarding missile procurement apparatus, program's needs, and illicit procurement trends, which could help industry better identify suspicious enquiries. When combined or shared, this information from the private sector and government can potentially allow for more effective risk mitigation.

Rakon UK heavily bolstered its internal compliance program and enacted enhanced beyond-compliance measures necessary to prevent exploitation by proliferators. This included additional due diligence measures, going beyond checking customer details against various sanction lists to conduct basic open source internet searches to identify inconsistencies within prospective transactions. These measures meant that the company was more effectively able to separate the suspicious enquiries from the legitimate ones, and avoid doing business with entities likely to be involved in missile or WMD proliferation.

Sharing information about suspicious enquiries and illicit trade between industry and government does not come without challenges.[62] Companies may be concerned about potential

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[61] For an account of the challenges faced by industry and the full story of Rakon's efforts to prevent involvement in illicit trade see: Daniel Salisbury and David Lowrie, 'Targeted: A case in Iranian Illicit Missile Procurement', *Bulletin of the Atomic Scientists*, (Vol.69, No.3, May/June 2013), pp.23-30.

[62] Daniel Salisbury, "How the Private Sector Can Do More to Prevent Illicit Trade", *Arms Control Today*, (Vol.43, July/ August 2013), p.27.

prosecution if they have been in contact with entities linked to WMD programs, even if they forgo business transactions. Conversely, there are clear barriers for government to overcome in finding ways to share information about proliferation networks, which is often derived from classified intelligence.

Seeking to engage industry in nonproliferation efforts will only be effective in cases where there is a comprehensive export control system in place, and where the state is a willing and receptive participant. Several steps can help to build a dialogue between industry and government to share information and encourage beyond-compliance practices: conducting training on proliferation risks as well as the export control system, providing a point of contact for information sharing with government, and providing other opportunities for industry to engage such as at trade shows. A "neutral" third party – such as a trade association, a nongovernmental organization, or academic institution – could prove useful in coordinating engagement efforts, and allaying industry concerns.

Unilateral Tools to Counter Proliferation Networks

The sanctions regime imposed against North Korea –both to constrain North Korea's supply of WMD-related goods and affect its willingness to continue these programs– is amongst the most extensive in history. However, it has not prevented the country from successfully testing an ICBM. It is possible that supply-side measures have slowed development by delaying or preventing North Korea's procurement of key chokepoint technologies. It is also highly likely that supply-side controls have raised the costs for North Korea in procuring missile- and other WMD-related goods. However, the UN Panel of Experts' view in 2013 that sanctions had "in all likelihood considerably delayed the timetable" of North Korea's WMD programs has been replaced by deep seated questioning regarding the "efficacy" of the UN sanctions regime.[63] Clearly, supply-side controls cannot defeat a determined and entrepreneurial proliferator.

Besides not having the full intended effect, this extensive web of sanctions has had significant unintended consequences. The scholarly literature on sanctions has tended to under-consider these unintended effects, the implications of criminalization, and how this can further state-sponsored crime and innovation amongst sanctions-busters.[64] Some of these arguments regarding criminalization and state-sponsored crime are redundant in this case –North Korea was undertaking criminal activity long before the expansion of sanctions over the past decade.

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[63] See for example, UN Security Council, 'Report of the Panel of Experts Established Pursuant to Resolution 1874 (2009)', S/2013/337, 11 June 2013, p.5; UN Security Council, 'Report of the Panel of Experts Established Pursuant to resolution 1874 (2009)', S/2016/157, 24 February 2016, p.4.

[64] See Peter Andreas, "Criminalizing Consequences of Sanctions: Embargo Busting and Its Legacy", *International Studies* Quarterly, (Vol.49, Is.2, June 2005) p.338.

However, other unintended consequences are apparent. Recent research by John Park and Jim Walsh has noted that the risk posed by sanctions has been increasingly monetized by China-based middlemen.[65] As a result these networks have become more capable, are able to offer a broader range of services including financing and logistics, and have become larger and more resilient. The large Chinese networks trading in both regular commodities and dual-use goods subject to US sanction and asset seizure in 2016 and 2017 likely reflect these trends. The Dandong Hongxiang Industrial Development Co. (DHID) network purportedly accounted for 20% of China-North Korea trade in 2010, and the Chi Yupeng network accounted for almost 10% of Chinese imports from the DPRK in 2016.[66] Aaron Arnold has also emphasized the way in which proliferation networks can adapt and innovate, particularly in response to nonproliferation tools.[67] However, while much work has been undertaken on WMD-related illicit trade, there has been relatively little work which has sought to conceptualize the activities of these networks.

There has also been little effort to consider how these networks might be countered in a proactive way –especially when overseas governments are unwilling or unable to act. The US, and to a lesser extent a small number of other states, have taken some unilateral action, using targeted sanctions and designations. More recently, newer tools have been used against proliferation networks by the US on a very limited scale, borrowing from the playbook used to counter other illicit activities such as narcotics trafficking. For example, to counter Chinese serial supplier of Iran's missile program Karl Lee, in 2014 the US government issued a FBI wanted poster, a $5million reward for information leading to his capture and seized almost $7million of his network's assets.[68] More recently, civil asset forfeiture has been used against DHID and other large North Korean networks based in China.[69] These tools cannot be utilized without political, bureaucratic and practical consequences, particularly in terms of affecting the willingness of overseas governments to cooperate on nonproliferation. The challenges and opportunities presented by these tools need full exploration.

Conclusions: Lessons for Nonproliferation?

While the genesis of recent North Korean success in its missile program –and particularly the role of external sources of technology *vis a vis* indigenization– remains hotly disputed, there are

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[65] Park and Walsh, 'North Korea Inc.', p.2.
[66] Peter Whoriskey, "U.S. lawsuit lays out China-North Korea network", *Washington Post*, 23 August 2017.
[67] See Aaron Arnold, "A Resilience Framework for Understanding Illicit Nuclear Procurement Networks", *Strategic Trade Review*, (Vol.3, No.4, Spring 2017), pp.3-23.
[68] For discussion of this case, see Nick Gillard and Daniel Salisbury, 'The obscure Chinese businessman accused of selling missile parts to Iran', *Vice,* 23 July 2015.
[69] "Four Chinese Nationals and China-Based Company Charged with Using Front Companies to Evade U.S. Sanctions Targeting North Korea's Nuclear Weapons and Ballistic Missile Programs", Department of Justice press release, 26 September 2016, <https://www.justice.gov/opa/pr/four-chinese-nationals-and-china-based-company-charged-using-front-companies-evade-us>, accessed 10 July 2018.

clearly lessons which can be derived from the case for future missile nonproliferation efforts. In terms of general lessons, the inadequacy of supply-side controls alone, and especially in preventing missile development by a determined proliferator, is clear. North Korea's procurement networks have shown themselves to be more than capable of acquiring dual-use technologies from the international market place. An apparent focus on procurement and replication of advanced manufacturing technology appears to have led North Korea to indigenize processes required to produce missile technologies, further limiting the effects of sanctions. Lax implementation of sanctions and related supply-side controls has been a major factor in undermining their success. However, this is not unusual, being seen in the clear majority of cases where UN sanctions and arms embargos have been put in place.

The case has highlighted the need for continued efforts to implement UNSCR1540. Almost 14 years after the resolution was passed, efforts need to be maintained to ensure that the capacity building activities which come under the umbrella of the resolution are continued. Part of this includes work to engage the private sector. The resolution states that governments should "develop appropriate ways to work with and inform industry and the public regarding their obligations".[70] The example of Rakon UK provided above illustrates how aware and proactive suppliers of missile-related dual-use goods can play a proactive role in missile nonproliferation. Other means of encouraging a constructive and proactive dialogue between government and industry have been discussed.

To counter proliferation networks operating in jurisdictions which are less willing to assist, efforts need to be made to further explore new and existing unilateral tools. Efforts to enhance this unilateral toolset need to begin with further research into proliferation networks—seeking to understand how they operate, adapt to new nonproliferation tools and shop for jurisdictions. The existing US unilateral toolset clearly draws from the playbooks used to counter illicit activities in other areas; are there further tools which could be borrowed? Consideration of these unilateral tools also needs to take into account possible unintended consequences, to avoid unintended political effects and –if possible– avoid making illicit trade more profitable for the middlemen.

[70] UN Security Council Resolution 1540, 28 April 2004, S/RES/1540, OP.8.d.